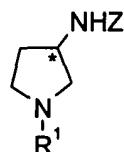


1 [0039] What is claimed is:

2

3 1. A process for the manufacture of 3-amino-pyrrolidine derivatives of the  
4 formula



I

5

6 wherein

7 R¹ signifies hydrogen or an amino protecting group;

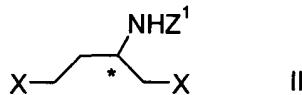
8 Z signifies hydrogen or an amino protecting group;

9 and

10 \* represents a center of chirality,

11 which process comprises:

12 converting a compound of the formula



13

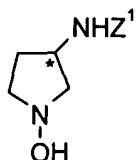
II

14 wherein

15 X signifies a protected hydroxy group; and

16 Z¹ signifies an amino protecting group;

17 in the presence of hydroxylamine or an acid addition salt thereof into the N-  
18 hydroxy-pyrrolidine derivative of the general formula

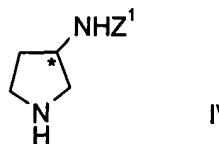


III

19

20 and

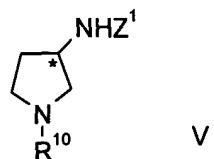
21 reducing the N-hydroxy group to the secondary amine of the general  
22 formula



1  
2 by hydrogenation with Raney nickel.

3

4 2. The process according to claim 1, further comprising protecting the  
5 secondary N¹ amino group by reaction with a compound of the formula R¹⁰X¹, in  
6 which R¹⁰ is an amino protecting group and X¹ is halogen or a leaving group, to  
7 yield a compound of the general formula

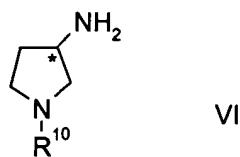


8

9

10

11 3. The process according to claim 2, further comprising deprotecting the  
12 secondary 3-amino group by catalytic hydrogenation to yield a compound of the  
13 general formula



14

15

16

17 4. The process according to claim 1, wherein the center of chirality is in the  
18 R-form.

19

20 5. The process according to claim 1, wherein X is mesyloxy.

21

22 6. The process according to claim 1, wherein Z¹ is benzyloxycarbonyl.

1

2    7.    The process according to claim 1, wherein the starting compound of formula  
3    II is reacted with hydroxylamine hydrochloride.

4

5    8.    The process according to claim 2, wherein the intermediate of formula IV is  
6    reacted with di-tert-butyl-dicarbonate.

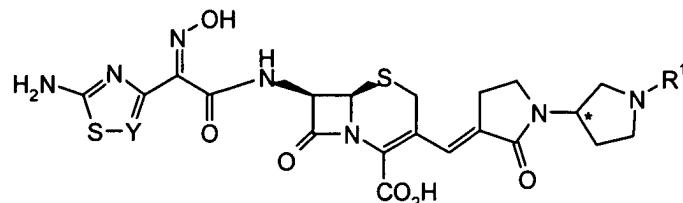
7

8    9.    The process according to claim 3, wherein the deprotection of the  
9    secondary 3-amino group of the intermediate of formula V is effected by catalytic  
10   dehydrogenation with palladium on charcoal.

11   10.   The process according to claim 1, wherein each step is carried out under  
12   pressure.

13

14   11.   The process in accordance with claim 1, wherein the 3-amino-pyrrolidine of  
15   formula I is further processed to a vinylpyrrolidinone-cephalosporin derivative of  
16   formula A



17

18   wherein

19       Y signifies CH or nitrogen;

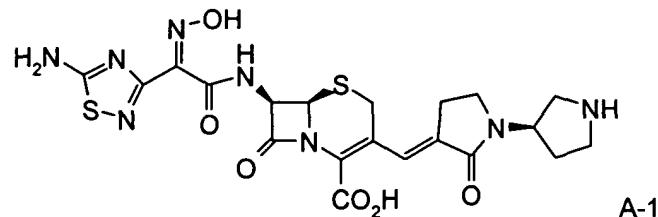
20       R<sup>1</sup> denotes hydrogen or an amino protecting group; and

21       \* denotes a center of chirality.

22

1    12.    The process according to claim 10 for the production of (6R,7R)-7-[(Z)-2-(5-  
2    amino-[1,2,4]thiadiazol-3-yl)-2-hydroxyimino-acetylamino]-8-oxo-3-[(E)-(R)-2-oxo-  
3    [1,3']bipyrrolidinyl-3-ylidenemethyl]-5-thia-1-aza-bicyclo[4.2.0]oct-2-ene-2-  
4    carboxylic acid of the formula

5



A-1